

DEPARTMENT OF TRANSPORTATION
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June 6, 2003

04-SF-80-13.2/13.9
04-0120F4
ACBRIM-080-1(095)N

Addendum No. 8

Dear Contractor:

This addendum is being issued to the contract for construction on State highway in SAN FRANCISCO COUNTY IN SAN FRANCISCO FROM 0.6 KM TO 1.3 KM EAST OF THE YERBA BUENA TUNNEL EAST PORTAL.

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on September 16, 2003, instead of the date of August 5, 2003.

This addendum is being issued to change the bid opening date as shown herein and revise the Project Plans, the Notice to Contractors and Special Provisions, and the Proposal and Contract.

Project Plan Sheets 405, 414, 418, 419, 420, 421, 422, 436, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 474, 477, 494, 495, 496, 498, 502, 669, 671, 673, 675, 693, 752, 753, 754, 758, 853, 856, 857, and 936 are revised. Half-sized copies of the revised sheets are attached for substitution for the like-numbered sheets.

Project Plan Sheet 24A is added. A half-sized copy of the added sheet is attached for addition to the project plans.

In the Special Provisions, Section 5-1.27, "PAYMENTS," in the sixth paragraph, Item O is added as follows:

"O. S-Wire wrapping"

In the Special Provisions, Section 10-1.01, "ORDER OF WORK," subsection "DESIGNATED PORTIONS OF WORK" the first sentence of Item "A. Designated Portion "1" of the Work" of the first paragraph is revised as follows:

"The Designated Portion "1" of the Work shall be defined as the completion of all elements of work, as shown on the plans and special provisions, necessary to allow the completion of Hinge "K" by the YBI Structures contractor prosecuting Contract No. 04-0120P4 as provided for under "Cooperation," of these special provisions."

In the Special Provisions, Section 10-1.01, "ORDER OF WORK," subsection "DESIGNATED PORTIONS OF WORK" the last sentence of Item "A Designated Portion "1" of the Work" of the first paragraph is revised as follows:

"Once this Designated Portion "1" of Work is complete by the Contractor, the YBI contractor prosecuting Contract No. 04-0120P4 shall be provided full and unrestricted access to the Hinge "K" work area by the Contractor."

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In the Special Provisions, Section 10-1.08, "COOPERATION," Item 6 of the third paragraph is deleted.

In the Special Provisions, Section 10-1.17, "ELECTRONIC MOBILE DAILY DIARY SYSTEM DATA DELIVERY," subsection "DATA DELIVERY REQUIREMENTS," the last paragraph is deleted.

In the Special Provisions, Section 10-1.18, "MOBILIZATION," the first sentence of the second paragraph is revised as follows:

"Attention is directed to Section 5-1.27 "PAYMENTS" of these special provisions, and Sections 9-1.06, "Partial Payments," and 9-1.07, "Payment After Acceptance," of the Standard Specifications."

In the Special Provisions, Section 10-1.18, "MOBILIZATION," the second sentence of the third paragraph is revised as follows:

"The retention of funds provisions in Section 5-1.27, "PAYMENTS" and Section 9-1.06, "Partial Payments," shall apply to the contract lump sum item of mobilization."

In the Special Provisions, Section 10-1.35, "EPOXY ASPHALT CONCRETE SURFACING," is revised as attached.

In the Special Provisions, Section 10-1.44, "SHEAR KEY (PIER E2)," subsection "GENERAL" the sixth paragraph is revised as follows:

"WHEMCO Group of Companies has agreed to furnish the shear key housing, shear stub, and other services described in these special provisions at the guaranteed price of \$263,450.00 per shear key stub and \$276,830.00 per shear key housing. In addition to the above prices, there will be a one time charge of \$21,430 for the shear key stub pattern and a one time charge of \$22,150 for the shear key housing pattern."

In the Special Provisions, Section 10-1.44, "SHEAR KEY (PIER E2)," subsection "GENERAL" the ninth paragraph is revised as follows:

"The above prices will be guaranteed for orders placed with WHEMCO on or before December 31, 2003. The total price will be increased 3 percent for orders placed with WHEMCO after December 31, 2003 and on or before December 31, 2004. The FOB location is Midland, Pennsylvania."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "GENERAL" the fourth and fifth paragraphs are revised as follows:

"Attention is directed to "Welding" and "Audits" in Section 8, "Materials," of these special provisions. Members shown on the plans with Seismic Performance Critical Member (SPCM) designations, including welds connecting SPCMs to other members shall conform to the requirements in ANSI/AASHTO/AWS D1.5, Section 12, "AASHTO/AWS Fracture Control Plan (FCP) for Non-Redundant Members" as modified herein."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "DEFINITIONS" the sixth paragraph is revised as follows:

"The "Seismic Performance Critical Member" ("SPCM") designation identifies structural elements, including welds connecting SPCMs to other members, that are critical to the seismic performance of the bridge and that are fabricated and inspected to the requirements of AWS D1.5, Section 12, as modified by these special provisions."

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In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "ERECTION PLAN" Item H of the fourth paragraph is revised as follows:

"H. Timing and methods for visual and nondestructive examination."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "CASTINGS" is revised as follows:

"CASTINGS"

Castings shown on the plans as "Structural Casting Grade 345," "Structural Casting Grade 415," and "Structural Casting Grade 550" shall conform to the requirements of these special provisions. Castings for suspension, hangar and other cable system components shall conform to the requirements in "Cable System" of these special provisions.

At the option of the Contractor, the remaining portions of the casting components may be redesigned as castings in accordance with the requirements of this section. Any use of castings for other structural components shall follow the requirements of this section, and a detailed, written proposal shall be submitted to the Engineer for prior approval. The Contractor shall submit for the approval of the Engineer, working drawings for castings in accordance with the requirements of "Working Drawings," of these special provisions. Working drawings for castings shall include, at a minimum, detail drawings of the redesigned cast configuration showing equivalency to the details shown on the plans.

The Contractor shall perform finite element complex heat flow analysis for each pattern including all risers and gates that demonstrates that final solidification will occur outside of the final casting. This analysis shall also be used to confirm inspection procedures by identifying the locations of likely defects such as shrinkage, hot tears and porosity. The analytical solid model shall be sufficiently detailed and accurate to demonstrate complete coverage of ultrasonic examination by including the ability to superimpose ultrasonic beam paths on the model. Coverage may be demonstrated by drawing beam paths on printed sections of the solid model. The analytical model and supporting calculations shall be submitted to the Engineer for approval in accordance with the "Working Drawings" section above.

The Contractor shall submit a manufacturing procedure to the Engineer for approval that shall specify all chemical, heat treatment, testing, visual and nondestructive inspection and quality control requirements. Quality control requirements and manufacturing facilities shall be subject to a quality audit as specified in Section 8-4 "Steel Audits" of these special provisions and include the additional requirements of this section.

Castings shall be manufactured to the requirements in ASTM Designation: A148 with the following Supplementary Requirements as modified herein: S1, S4, S5, S6, S7, S8 (Individually marked), S9, S12, S15 (S15.3.2, except one test coupon shall be 3T by 3T by T for all T as described below), and S16.

The manufacturing procedure shall define the specific chemistry, including tolerances for each element. The alloy shall conform to the general limits in the following table, except alternative alloys that meet the required mechanical properties and other requirements herein, that have similar or better weld ability, and that have a documented history of successful application may be submitted for approval by the Engineer. The steel shall be fully killed and made to fine grain practice.

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ELEMENT (Max. or range)	BASE GRADE	C	Si	Mn	P	S	Ni	Cr	Mo
Structural Casting Grade 345	A148M, Gr. 550- 345	0.20	0.60	1.50	0.02	.010	1.2	0.50	0.25
Structural Casting Grade 415	A148M, Gr. 620- 415	0.28	0.80	1.00	0.02	.010	1.40 - 2.00	0.55- 0.90	0.20- 0.40
Structural Casting Grade 550	A148M, Gr. 725- 585	0.24	0.50	0.55 - 0.75	0.02	.010	2.50 - 3.50	1.35- 1.85	0.30- 0.60

ELEMENT (Max. or range)	BASE GRADE	Al	Cu	V	Cb	Ti	CE
Structural Casting Grade 345	A148M, Gr. 550- 345	.010 – .060	0.30	0.03	0.03	0.05	0.51
Structural Casting Grade 415	A148M, Gr. 620- 415	.010- .030	0.50*	0.03*	0.03	0.05	0.90
Structural Casting Grade 550	A148M, Gr. 725- 585	.010- .030	0.20*	0.03*	0.03	0.05	-

Notes: * means not intentionally added.

$$CE = C + (Mn+Si)/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15$$

Each casting shall be given a double normalized or a normalized plus quench and temper heat treatment at temperatures and times specified in the manufacturing procedure except the final tempering temperature shall not be less than 565 C. Specimens for mechanical testing shall be taken from a representative casting, a prolongation to the casting or a keel block. The test specimen block shall have a section size equivalent to 1/3T of that shown on the plans, be poured from the same ladle and heat treated along with the castings that it represents. The test specimens shall meet the requirements in the table below. In addition, a separate keel block with the equivalent maximum section size shown on the plans shall be poured from the same heat, heat treated along with the casting and machined to provide two tensile test specimens. The tensile yield and ultimate strengths of these specimens shall not be less than 90% of the minimum strengths specified in the table below.

	STRUCTURAL CASTING GRADE 345	STRUCTURAL CASTING GRADE 415	STRUCTURAL CASTING GRADE 550
Tensile Strength:	550 MPa – 690 MPa	620 MPa – 795 MPa	680 MPa – 840 MPa
Yield Strength:	345 MPa, Minimum	415 MPa, Minimum	550 MPa, Minimum
Elongation:	22%, Minimum	20%, Minimum	18%, Minimum
Reduction of Area:	35%, Minimum	35%, Minimum	30%, Minimum
Charpy V-Notch:	42 J, Minimum at 0° C	42 J, Minimum at 0° C	90 J, Minimum at 0° C

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Each casting shall be visually examined 100% on all surfaces and shall be free of adhering sand, scale, cracks, shrinkage, unfused chills and hot tears and meet the Manufacturing Standardization Society of the Valve and Fittings Industry Inc. Publications (MSS) specification MSS-SP-55, "Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method". Machined surfaces shall be free of voids or other discontinuities that exceed the following: A maximum of one discontinuity within a radius of 150 mm that has a diameter not exceeding 3 mm within the saddle troughs or 5 mm elsewhere, a maximum depth of one half of the diameter, and a rounded shape with no sharp corners. Voids within the saddle troughs shall be filled during metallizing.

Each casting shall be examined 100% on all surfaces by visible contrast, wet magnetic particle method to ASTM Designation: E709 on the final, as-finished surface. The prod method shall not be used on Grades 415 or 550 and shall be controlled to eliminate arcing. Linear indications, defined as having a ratio of maximum to minimum dimensions greater than 3, tears and cracks will not be permitted.

Each casting shall also be volumetrically examined 100% by ultrasonic (UT) methods in accordance with a written procedure submitted with the manufacturing procedure. The procedure shall define calibrations, equipment and materials and shall include part-specific shooting sketches that demonstrate complete coverage of the full volume from two perpendicular directions. Coverage shall be compatible with locations identified as possible locations for defects based on the finite element heat flow analysis and the foundry practice.

Ultrasonic procedures shall be based on ASTM Designation: A 609, "Standard Specification for Longitudinal Beam Ultrasonic Inspection of Carbon and Low-Alloy Steel Castings," using Procedure A, except supplementary angle beam examination to Supplementary Requirement S1 shall be performed on castings to ensure coverage from two perpendicular directions and on areas of castings where a back reflection cannot be maintained during straight beam examination, or where the angle between the front and back surfaces of the castings exceeds 15 degrees. The Distance Amplitude Curve (DAC) method shall be used for both straight and angle beam examinations. The DAC shall be constructed using a 3.0 mm diameter reference reflector hole for areas within 30 mm of the final surface unless noted otherwise on the plans, and areas designated as Level 1 on the plans, and a hole diameter as specified in ASTM Designation: A 609M shall be used elsewhere. At each facility producing castings, ultrasonic test calibration blocks shall be poured from the first casting heat produced for this contract. The calibration blocks shall be made available to the Engineer for use in QA testing of the castings and to any subcontractors that perform ultrasonic testing on the castings. All calibration details shall be defined in the procedure.

The ultrasonic examination acceptance criteria shall be as follows: Within 30 mm of any final surface, unless otherwise noted on the plans, and at locations designated as Level 1 on the plans, indications that provide a response equal to or greater than the DAC and that are planar or that exceed the area specified in ASTM Designation: A 609, Table 2 for ultrasonic testing quality Level 1 will not be permitted. At all other locations, indications that provide a response equal to or greater than the DAC and that are planar or that exceed the area specified in ASTM Designation: A 609, Table 2 for ultrasonic testing quality Level 3 will not be permitted. The method for determining whether a reflector is planar shall be defined in the written procedure and shall be based on the high directionality of amplitude response for planar reflectors or other established technique.

Each casting shall be stenciled with its heat number and serial number.

Before casting, the Contractor shall produce 1/10 scale model of the tower saddle in wood or other material approved by the Engineer. The model shall show all details of the saddle including the location of weld, cast and plate materials and cast component parting lines. The model and manufacturing procedure shall be approved by the Engineer before the start of foundry production.

All areas of steel castings that will be in contact with other elements by welding, bolting or direct contact pressure shall be machined.

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Unless noted otherwise on the plans, the tolerance for linear dimensions of unmachined sections shall have a plus and minus tolerance (i.e., one half of the total tolerance range) in accordance with the following table:

Tolerance For Linear Dimensions (mm) Unaffected By Machined Surfaces

LINEAR DIMENSION, L	L < 60	60 ≤ L < 120	120 ≤ L < 250	250 ≤ L < 400	400 ≤ L < 630	630 ≤ L < 1000	1000 ≤ L < 1600	1600 ≤ L < 2500	2500 ≤ L < 4000	4000 ≤ L
TOLERANCE	4.5	5.5	7.0	9.0	11.0	13.0	16.0	19.0	31.0	47.0

Unless noted otherwise on the plans, the thickness tolerance of unmachined ribs shall have a minus tolerance of 3 mm and a plus tolerance in accordance with the following table:

Plus Tolerance For Thickness Of Ribs (mm) Where Both Faces Are Not Machined

THICKNESS RANGE	t < 18	18 ≤ t < 30	30 ≤ t < 50	50 ≤ t < 80	80 ≤ t < 120	120 ≤ t < 180	180 ≤ t < 250	250 ≤ t < 315	315 ≤ t < 400	400 ≤ t
PLUS TOLERANCE	6.0	9.0	10.0	11.0	12.0	13.0	15.0	19.0	27.0	35.0

No coating or oil preservative shall be applied to a casting until that casting has been inspected and approved by the Engineer.

Minor defects may be removed by grinding or chipping without welding repair, in accordance with the following requirements:

- A. The removal of metal does not affect the strength, integrity or functionality of the casting, as determined by the Engineer.
- B. The remaining wall thickness is equal to or greater than the required minimum wall thickness.
- C. The surrounding metal is ground to a smooth contour with the elimination of apparent stress raisers.
- D. Specified tolerances on machined surfaces are satisfied.

Weld repairs may be permitted if qualified welding procedures are used that demonstrate Charpy V-Notch toughness of 34J at -30 C in the weld metal and 34J for Structural Casting Grades 345 and 415, or 60J for Structural Casting Grade 550, at 0 C in the heat-affected zone in the final delivery condition. Weld procedure tests shall be qualified on 50 mm thick plates poured from the same heat as the final casting. Weld repairs shall be given a post weld stress relief heat treatment after all welding is complete. All proposed repair or upgrading welding procedure specifications (WPSs) shall conform to the requirements of ASME Boiler and Pressure Vessel Code, Section IX, as modified herein. Additional essential variables required for WPSs other than SMAW shall include welding travel speed (limited to ±10%), heat input (limited to +10%, -30%), and, for FCAW, the brand name of the electrode. Weld procedures with all supporting procedure qualification records (PQRs) shall be submitted in writing to the Engineer for each welding location, and shall include a description of the defect or other need for welding, the size and the shape of the excavation, the welding procedure specification, preheat and post weld heat treatment. If a second repair to base metal or heat affected zone is required at the same location, the Contractor shall include a metallurgical evaluation for the cause of the rejection in the submittal package to the Engineer for review and approval.

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No welding or heat treatment will be permitted except with the specific written approval of the Engineer. In addition, the Contractor shall give the Engineer at least 12 hours notice prior to performing the work.

The exterior surfaces of the castings, after acceptance, shall be coated as specified in "Clean and Paint Structural Steel" and "Metallized Steel Surfaces" of these special provisions. The castings shall be carefully masked to avoid coating any high strength fastener contact surface, interior or other machine finished surface.

At the time of assembly, the contact surfaces of the castings shall meet the machine finish requirements shown on the plans."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Fabrication/Erection Procedure and Mock-Ups," Item KL of the third paragraph is revised as follows:

"K. Tower Strut Assembly including connection to Tower Diaphragm"

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Fabrication/Erection Procedure and Mock-Ups," Item B of the fourth paragraph is revised as follows:

"B. Tower Diaphragm Type 3B"

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Fabrication/Erection Procedure and Mock-Ups," Item F is added to the fourth paragraph as follows:

"F. Tower section"

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Fabrication/Erection Procedure and Mock-Ups," the sixth paragraph is revised as follows:

"For each mock-up, the Contractor shall prepare a written fabrication and welding sequence and a preliminary mock-up made of wood, plastic, dense Styrofoam or other material approved by the Engineer. The preliminary mock-up shall be sufficiently large to demonstrate the assembly sequence, but need not exceed one-half scale. These shall be submitted for review by the Engineer, and approval shall be given before the full-scale mock-up is fabricated in steel. The Engineer shall witness all fit-up and welding for each steel mock-up."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Bikepath at Pier W2," the first paragraph is revised as follows:

"A portion of the bikepath at Pier W2 will be furnished by the Contractor and installed by others, as shown on the plans. This portion of bikepath shall conform to the requirements of this section, including the requirements for cleaning and painting in section "Clean and Paint Structural Steel," of these special provisions."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Bolted Connections," the following paragraph is added after the first paragraph:

"The provisions of Section 8-1.01 "SUBSTITUTION OF NON-METRIC MATERIALS AND PRODUCTS," will not be permitted for high-strength fastener assemblies."

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In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Bolted Connections," the fifth paragraph is revised as follows:

"Bolted connections shall conform to the requirements in the Research Council on Structural Connections, "Specification for Structural Joints Using ASTM A325 or A490 Bolts," 2000 (RCSC Specification), with the following revisions:

- A. Reference to A325 bolts shall mean A325M bolts.
- B. Reference to A490 bolts shall mean A490M bolts.
- C. Reference to A563 nuts shall mean A563M nuts.
- D. Reference to F436 washers shall mean F436M washers.
- E. Reference to F959 direct tension indicators shall mean F959M direct tension indicators.
- F. Reference to F1852 twist-off type tension control bolts shall not apply.
- G. Reference to ANSI B18.2.6 (for bolt dimensions) is replaced with B.18.2.3.7M.
- H. Reference to ANSI B18.2.6 (for nut dimensions) is replaced with B.18.2.4.6M.
- I. Replace Table 2.1 of the RCSC Specification with Table 8.1 of the AISC "Manual of Steel Construction, Load & Resistance Factor Design, Metric Conversion of the Second Edition" (AISC Specification).
- J. Replace Table C-2.1, Figure C-2.2, and Table C-2.2 of the RCSC Specification with Table 8.2 of the AISC Specification.
- K. Replace Table 3.1 of the RCSC Specification with Table J3.3 of the AISC Specification.
- L. Section 6.2.3. of the RCSC is deleted.
- M. Table 6.1 of the RCSC Specification is replaced with the following:

Table 6.1. Washer Requirements for Bolted Joints with Oversized and Slotted Holes in the Outer Ply

ASTM Designation	Nominal Bolt Diameter db, mm	Hole Type in Outer Ply		
		Oversized	Short-Slotted	Long-Slotted
A325	12-36	ASTM F436M		8 mm thick plate washer or continuous bar ^{a,b}
A490	≤ 25			
	>25	ASTM F436M with 8 mm thickness ^a		8 mm thick hardened plate washer or hardened continuous bar ^a
^a Multiple washers with a combined thickness of 8 mm or larger do not satisfy this requirement.				
^b The plate washer or bar shall be of structural-grade steel material, but need not be hardened.				

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N. Replace Table 8.1 of the RCSC Specification with the following:

Minimum Bolt Tension, N*		
Bolt Size, mm	A325M Bolts	A490M Bolts
M16	91 000	114 000
M20	142 000	179 000
M22	176 000	221 000
M24	205 000	257 000
M27	267 000	334 000
M30	326 000	408 000
M36	475 000	595 000
*Equal to 0.70 of minimum tensile strength of bolts, rounded off to nearest kN and converted to N, as specified in ASTM specifications for A325M and A490M bolts with UNC threads.		

O. Table 8.2 of the RCSC Specification is replaced with the following:

Table 8.2. Nut Rotation from Snug-Tight Condition for Turn-of-Nut Pretensioning ^{a,b}			
Bolt Length ^c	Disposition of Outer Face of Bolted Parts		
	Both faces normal to bolt axis	One face normal to bolt axis, other sloped not more than 1:20 ^d	Both faces sloped not more than 1:20 from normal to bolt axis ^d
Not more than 4d _b	1/2 turn	1/2 turn	2/3 turn
More than 4d _b but not more than 8d _b	1/2 turn	2/3 turn	5/6 turn
More than 8d _b but not more than 12d _b	2/3 turn	5/6 turn	1 turn
^a Nut rotation is relative to bolt regardless of the element (nut or bolt) being turned. For required nut rotations of 1/2 turn, the tolerance is plus 30 degrees; for required nut rotations of 2/3 turn and more, the tolerance is plus 45 degrees. ^b Applicable only to joints in which all material within the grip is steel. ^c When the bolt length exceeds 12d _b , the required nut rotation shall be determined by actual testing in a suitable tension calibrator that simulates the conditions of solidly fitting steel. ^d Beveled washer not used.			

P. Sections 8.2.2, 8.2.3, 9.2.2, and 9.2.3 of the RCSC Specification are deleted.

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Where the DTI method is used, the DTI shall be collapsed to 0.075mm (3 mils), and the gap in the DTI shall be caulked after acceptance by the Engineer. The method of bolt tightening shall be as specified below:

LOCATION	BOLT TYPE	COATING	TIGHTENING METHOD
Tower	A325	Mechanical galvanizing	Turn-of-Nut or Direct Tension Indicator (DTI) collapsed to 3mils (0.075mm) on inside of Tower
	A490	Organic zinc coating	Turn-of-Nut or DTI collapsed to 3mils (0.075mm) on inside of Tower
Box Girder	A325	Mechanical galvanizing	Turn-of-Nut or DTI collapsed to 3mils (0.075mm) on inside of box
Tower Skirt	A307	Hot Dip Galvanized	Snug-Tight

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Bolted Connections," the following paragraphs are added after the sixth paragraph:

"At least 60 working days prior to beginning turn-of-nut bolting operations, the Contractor shall perform the following tests to verify turn-of-nut installation procedures:

A. Minimum tension shall be verified using the "Pre-Installation Verification Turn-of-the-Nut Method," of the "Structural Bolting Handbook," published by the Steel Structures Technology Center, Incorporated, except that the required rotation shall be as given in Table 8.2. of this section and the required tension shall be as shown in the following table:

**Pre-Installation Verification
Required Tension, N***

Bolt Size, mm	A325M Bolts	A490M Bolts
M16	96 000	120 000
M20	149 000	188 000
M22	185 000	232 000
M24	215 000	270 000
M27	280 000	351 000
M30	342 000	428 000
M36	499 000	625 000
*The above values are 5% higher than the required pretension values used for design, actual installation and inspection, rounded to the nearest kN.		

B. Rotational-capacity tests in accordance with the requirements in Section 11.5.6.4.2 "Rotational-Capacity Tests," of the AASHTO LRFD Bridge Construction Specifications, except that Table 11.5.6.4.1-2 "Nut Rotation from the Snug Condition," is replaced by Table 8.2. of this section.

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Test results shall confirm both the minimum bolt tension and the rotational capacity of the bolts. If either test fails, the Contractor shall modify the nut rotation in Table 8.2. of this section until the requirements of both tests are satisfied. No adjustment in compensation will be allowed for modifications to the nut rotations as necessary to satisfy test requirements. Revisions to Table 8.2. shall be approved by the Engineer prior to bolting operations.

The Engineer will randomly sample and perform quality assurance testing of high strength fasteners. Samples will be obtained at locations chosen by the Engineer. The Contractor shall provide the number of bolts specified below to the Engineer for quality assurance testing:

Bolt Sampling Size	
Lot Size (No. of Bolts)	Sample Size (No. of Bolts)
2 to 15	3
16 to 25	4
26 to 50	5
51 to 90	7
91 to 150	8
151 to 280	9
281 to 10,000	12
10,001 to 500,000	16
500,001 and over	20

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "FABRICATION," subsection "Bolted Connections," the seventh paragraph is replaced with the following paragraphs:

"Steel fasteners, designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall conform to the requirements of ASTM Designation: A 354. Steel fastener components for steel fasteners designated as A 354 shall include a bolt, nut and hardened washer. Nuts for steel fasteners designated as A 354 shall conform to Section 55-2.01, "Description," of the Standard Specifications.

Steel fasteners designated on the plans as A 354, Grade BD shall be dry blast cleaned in accordance with the provisions of Surface Preparation Specification No. 10, "Near White Blast Cleaning," of the "SSPC: The Society for Protective Coatings.

Steel fasteners designated on the plans as A 354, Grade BC, and A 354, Grade BD, shall be galvanized in accordance with the requirements in Section 75-1.05, "Galvanizing," of the Standard Specifications and shall conform to the requirements in ASTM Designation: A123 for bolts and ASTM Designation: A153 for nuts and hardware. Steel fastener assemblies designated as A354, Grade BD, shall be galvanized within 4 hours of being dry blast cleaned.

The Contractor shall submit certified test reports showing that the A 354, Grade BD fasteners conform to the provisions in ASTM Designation: A 143."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "WELDING OF HPS485W STEELS" in the third paragraph Item E is revised as follows:

"E. Backing; AWS D1.5, Section 5.4.5 is modified to allow steel backing material for WPS test plates to be of grade 345W (Sulfur = 0.025 max.) or HPS485W material."

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In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "WELDING OF HPS485W STEELS" the fourth paragraph which starts with "shall be qualified by testing ..." is revised as follows:

"WELDING OF GRADE 690 STEELS"

Welds in Grade 690 steels shall conform to the requirements of AWS D1.5, as modified herein. All welding procedures shall be qualified by testing in accordance with the requirements in AWS D1.5 as modified herein and shall be used within the qualified limits of heat input. Previously qualified welding procedures witnessed by the State may be submitted for review based on these specification requirements. Regardless of qualification range, the heat input, preheat temperature and maximum interpass temperature shall conform to the requirements of this section."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "SHOP WELDING," subsection "General Provisions," Item A is revised as follows:

"A. Steel fabrication shall conform to the requirements of AWS D1.5, except members designated on the plans as SPCMs, including welds connecting SPCM's to other members, shall be fabricated according to Chapter 12 of the AWS D1.5, "AASHTO/AWS Fracture Control Plan (FCP) for Nonredundant Members", except as modified in these special provisions.

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "SHOP WELDING," subsection "Design Details," Item F is revised as follows:

"F. Weld repairs – In addition to the provisions in AWS D1.5, Section 3.7.4, re-repair of welds or base metal requires prior approval of the Engineer. Repairs to SPCMs, including welds connecting SPCM's to other members, shall be as specified in AWS D1.5, "AASHTO/AWS Fracture Control Plan (FCP) for Nonredundant Member," Section 12.17, as modified herein."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "SHOP WELDING," subsection "Welding of Closed Ribs to Box Shell Plate," Item B, the fourth paragraph beginning with "At the completion of welding ..." is revised as follows:

"At completion of welding, the welded panels shall be checked for straightness and other production tolerances. The welded, unstraightened panel shall be flat within 10 mm. If the unstraightened panel is not flat within 10 mm, new measures such as different prebending or fixturing, shall be proposed, and new trial panels welded."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "SHOP WELDING," subsection "Welding of Closed Ribs to Box Shell Plate," Item C, the first paragraph is revised as follows:

"C. Monitoring of Production Welds – During fabrication, weld monitoring tests shall be conducted for each operator on each welding machine at the start of each work shift. Test specimens shall consist of a separate piece of deck plate and rib. The rib shall be tack welded to the test piece the same as on the panel. Run-on and run-off tabs may be used if used in the production plates. If the equipment is used in production to simultaneously weld multiple ribs, then at least two ribs shall be welded during the test. The specimen shall be at least 500 mm long, and shall be examined 100% by UT. The specimen shall be macroetched 25 mm from each end, at a tack weld, and at two intermediate locations, as determined by the Engineer, immediately after welding."

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In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "SHOP WELDING," subsection "Welding of Closed Ribs to Box Shell Plate," Item D, the first paragraph is revised as follows:

"D. Panel Production – The dimensions of production panels of box shell plating shall be checked after welding. The welded panel, after straightening, if any, shall be flat within 5 mm in each 5 m length of box panels. Panels may be straightened in accordance with a written procedure that is in conformance to AWS D1.5 and is approved by the Engineer."

In the Special Provisions, Section 10-1.51, "STEEL STRUCTURES," subsection "INSPECTION AND TESTING" the Notes following the table are revised as follows:

"Notes:

1) Vertical butt joints marked ** in the table shall be tested as follows:

(a) 1/6 of the web depth beginning at each end of weld, unless otherwise noted, shall be tested 100 %.

(b) 25 % of the remainder shall be tested.

2) If unacceptable discontinuities are found in a joint with 100% NDT, the repairs shall be completed and then re-examined by the same NDT method along with an additional 50 mm at each end of the weld repair, for a minimum total additional length of 100 mm.

3) If unacceptable discontinuities are found in a joint with a specified percentage of NDT less than 100 %, including RT examination of butt weld repairs, the repairs shall be completed and then re-examined by the same NDT method along with an additional 50mm at each end of the weld repair, for a minimum total additional length of 100mm for the repair re-examination. Two additional previously untested segments, each at least 10% of the total weld length, on each side of the repair, for a total additional length of 20%, shall be tested with the same NDT method. If additional unacceptable discontinuities are found as a result of this testing, then 100% of the remaining untested portion of the weld shall be tested with the same NDT method. All weld repairs shall be tested with the same NDT method that located the original defect.

4) Where the specified percentage of testing is greater than 25 %, the specified length of each weld shall be tested.

5) Where the specified percentage of testing is 25 %, each weld that is 1.5 m long or more shall be examined over 25 % of the weld length. Welds under the same table category in the same component that are less than 1.5 m long may be lot examined by testing one weld 100 % for each lot of four welds.

6) Where the specified percentage of testing is 15 %, each weld that is 2.5 m long or more shall be tested over 15 % of the weld length. Welds under the same table category in the same component that are less than 2.5 m long may be lot examined by testing one weld 100 % for each lot of seven welds.

7) Where the specified percentage of testing is 10 %, each weld that is 4.0 m long or more shall be examined over 10 % of the weld length. Welds under the same table category in the same component that are less than 4.0 m long may be lot examined by testing one weld 100 % for each lot of ten welds.

8) For lot examination, if unacceptable discontinuities are found in the weld tested, the remainder of that weld shall be tested, and a second weld in the lot will be chosen by the Engineer and shall be tested. If unacceptable discontinuities are found in the second weld, the entire lot shall be tested.

9) UT examination of PJP welds shall confirm the specified weld size and, for weld sizes greater than 15 mm, shall also evaluate the accessible weld volume to the requirements of AWS D1.5 for welds in compression.

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10) Welds, and adjacent parent material within 10 mm of all accessible areas surrounding the weld, in grades with strength levels of 485 and above shall be tested 100% by MT in addition to other specified inspection. The timing of visual and any method of NDT for welds in these steels shall be in accordance with AWS D1.5, Section 12.16.4.

11) Welds made by either the electroslag or electrogas processes shall be examined 100% by both radiographic and ultrasonic testing.

12) Scanning for ultrasonic examination of corner, tee and cruciform welds in thicknesses greater than 50 mm shall include base metal behind and adjacent to the welds. Lamellar tearing discontinuities that exceed 3 mm or that lie within 10 mm of the surface shall be repaired.

13) SPCMs shall include welds connecting SPCM's to other members."

In the Special Provisions, Section 10-1.52, "CABLE SYSTEM," subsection "MATERIALS AND FABRICATION," subsection "Cable Wrapping Wire," the first sentence of the second paragraph is revised as follows:

"The S-shaped cable wrapping wire shall be manufactured by the following supplier:"

In the Special Provisions, Section 10-1.52, "CABLE SYSTEM," subsection "MATERIALS AND FABRICATION," subsection "Cable Wrapping Wire," the seventh paragraph is revised as follows:

"The price quoted by the manufacturer for S-shaped cable wrapping wire is \$5.50 per kilogram. The manufacturer's charge for a technical supervisor is \$1,400 per person per day, and \$25,000 per person per month (20 working days per month). These charges apply from the day of departure from Japan to the day of return back to Japan. The daily allowance for a technical supervisor shall be \$125 per person per day. The charge for round trip airfare between Japan and San Francisco, California, United States, shall be \$4,200 per person. The FOB location is Yokohama, Japan. Quoted prices are in United States dollars."

In the Special Provisions, Section 10-1.52, "CABLE SYSTEM," subsection "MATERIALS AND FABRICATION," subsection "Cable Wrapping Wire," the ninth paragraph is revised as follows:

"The S-wire wrapping price includes all materials, technical advice and inspection by a qualified representative of the manufacturer during installation and final inspection of the installed S-wire wrapping."

In the Special Provisions, Section 10-1.64, "CLEAN AND PAINT CABLE SYSTEM," subsection "MATERIALS," the first paragraph is revised as follows:

"The cable painting system shall consist of a primer, a two intermediate coat Noxyde painting system, or equal, and a finish coat. The Noxyde cable painting system shall be manufactured by the following supplier:"

In the Special Provisions, Section 10-1.64, "CLEAN AND PAINT CABLE SYSTEM," subsection "MATERIALS," the third paragraph is revised as follows:

"The intermediate and finish coats shall be a water-borne, single component semi-paste acrylic with highly elastic polymers. The coats shall be capable of 200 percent elongation, and shall be 100 percent waterproof and 100 percent resistant to ultraviolet radiation. The two intermediate coats shall be 100 percent Noxyde Plus."

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In the Special Provisions, Section 10-1.64, "CLEAN AND PAINT CABLE SYSTEM," subsection "MATERIALS," the tenth paragraph is revised as follows:

"The intermediate coats of the cable paint system shall conform to the following physical requirements:"

In the Special Provisions, Section 10-1.64, "CLEAN AND PAINT CABLE SYSTEM," subsection "PAINTING," the sixth and seventh paragraphs are revised as follows:

"The intermediate coat shall be applied within 24 hours of the application of primer coat, weather permitting, except for the handrope stanchions, main cable shrouds, and the surfaces of cable band castings, tower saddle castings, and splay saddle castings. All undercoat surfaces showing evidence of contamination, as determined by the Engineer, shall be cleaned. The Engineer shall be the sole judge of the need for cleaning.

The intermediate coat shall be applied in accordance with the manufacturer's recommendations. The two intermediate coats shall be spray applied in a fine even spray so as to produce a uniform coating. The total dry film thickness of the two intermediate coats shall be between 200 μm and 350 μm ."

In the Special Provisions, Section 10-1.64, "CLEAN AND PAINT CABLE SYSTEM," subsection "PAINTING," the twelfth paragraph is revised as follows:

"The finish coat shall be applied in accordance with the manufacturer's recommendations. The finish coat shall be applied to produce a uniform coating. The dry film thickness of the finish coat shall be 35 μm ."

In the Special Provisions, Section 10-3.08, "SUPPORT HARDWARE FOR CONDUITS, CABLE TRAYS AND WIREWAYS," subsection "CABLE TRAY LADDER TYPE," the following subsection is added after subsection "Cable Tray Sections and Components":

"Cable Tray Solid Trough Type

The solid trough type tray shall be the same as ladder type cable tray specified elsewhere in these special provisions except for the following. It shall be a solid bottom trough type tray with two longitudinal members (side rails) with a corrugated bottom welded to the side rails. The peaks of the corrugated bottom shall have a minimum flat cable-bearing surface of 70 mm and shall be spaced on 152-mm centers. The cable trays may be manufactured by B-Line Systems, Chalfant, or other approved manufacturer. Solid bottom trays with covers shall be used for communications and signal wire trays. Tray fittings shall include all reducers, and vertical and horizontal bends. Cable tray shall be supported at intervals of not more than 4.74 m. All conduit terminating at trays shall provide a continuous cable route by using bushings specifically suited for attaching conduit to the tray rail and for providing ground continuity."

In the Special Provisions, Section 10-3.10, "CONDUCTORS, CABLES AND WIRING," the following subsection is added after subsection "600 VOLT MULTI-CONDUCTOR CABLE":

"600 VOLT ARMORED MULTI-CONDUCTOR CABLE

The 600-volt armored cable shall be used for call box power supply and bike path lighting as shown on the roadway eastbound plan sheet.

The individual conductor of the armored cable shall conform to the 600-volt cable requirements as specified above in the special provisions.

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The armor sheath shall exceed the grounding conductor requirements of Table 250-95 of the National Electrical Code and UL 1569. The armor sheath shall be impervious, continuous, welded, corrugated aluminum that will provide complete protection against moisture, liquid, and gases, and has excellent mechanical strength. The armor sheath shall be covered with low temperature black polyvinyl chloride to protect the cable against chemical attack.

The cable shall have stranded copper grounding conductor, located in the outer interstices. The cable shall be UL Listed as type MC cable per Article 334 of the NEC."

In the Special Provisions, Section 10-3.10, "CONDUCTORS, CABLES AND WIRING," the following subsection is added after subsection "SHIELDED TWISTED PAIR CABLE":

"600 Volt Shielded-Twisted Pair Armored Cable

The 600 V instrumentation armored cables shall be used for call box communication as shown on the roadway eastbound plan sheet.

The individual conductor of the armored cable shall conform to the shielded-twisted pair cable requirements as specified above in the special provisions.

The armor sheath shall be impervious, continuous, welded, corrugated aluminum that will provide complete protection against moisture, liquid, and gases, and shall have excellent mechanical strength and provide equipment grounding through the sheath. The armor sheath shall be covered with low temperature black polyvinyl chloride to protect cable against chemical attack.

The cable shall be UL Listed as ITC/PLTC in accordance with Article 727 and Article 725 of the NEC. Cables shall comply with UL 2250 and UL 13 for PLTC, CL2, and CL3."

In the Special Provisions, Section 10-4.02, "PIPE, FITTING AND VALVES," subsection "PART 2.-PRODUCTS," subsection "MATERIALS, PIPE AND FITTINGS," the following subsection is added after subsection "Hinged Flex Joint":

" Manufactured Expansion Loop for Compressed Air and Water

Provide flexible expansion loops of size noted on drawings. The loop shall consist of flexible sections series 300 SS hose and braid, and two steel end nipples with cut grooves for groove-couplings and gaskets. Loops shall be installed in a neutral condition unless noted otherwise.

Install loop within four pipe diameters, both upstream and downstream, from a pipe guide or anchor. Loop shall be Metaflex, Metraloop or equal."

In the Proposal and Contract, the Engineer's Estimate for both Alternatives 1 and 2, Items 161 and 162 are added and Items 152 and 160 are deleted as attached.

To Proposal and Contract book holders:

Replace pages 35 and 43 and add pages 35A and 43A of the Engineer's Estimate in the Proposal with the attached revised and added pages 35, 35A, 43, and 43A of the Engineer's Estimate. The revised Engineer's Estimate is to be used in the bid.

Attached are the following: A copy of additional Materials Information and a readable CD ROM.

Indicate receipt of this addendum by filling in the number of this addendum in the space provided on the signature page of the proposal.

Submit bids in the Proposal and Contract book you now possess. Holders who have already mailed their book will be contacted to arrange for the return of their book.

Inform subcontractors and suppliers as necessary.

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This office is sending this addendum by UPS overnight mail to Proposal and Contract book holders to ensure that each receives it. A copy of this addendum and the modified wage rates are available for the contractor's use on the Internet Site:

http://www.dot.ca.gov/hq/esc/oe/weekly_ads/addendum_page.html

If you are not a Proposal and Contract book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,

ORIGINAL SIGNED BY:

REBECCA D. HARNAGEL, Chief
Office of Plans, Specifications & Estimates
Office Engineer

Attachments

10-1.35 EPOXY ASPHALT CONCRETE SURFACING

Epoxy asphalt concrete surfacing shall be furnished and placed in conformance with the provisions in Section 39, "Asphalt Concrete," of the Standard Specifications and these special provisions.

The furnishing of epoxy asphalt concrete surfacing will require the modification of an asphalt concrete batch plant, the use of a special metering mix machine, and the purchasing of epoxy asphalt binder from a sole source supplier in order to provide epoxy asphalt concrete surfacing as specified herein. The placing of epoxy asphalt concrete surfacing will require the use of a special bond coat spray distributor and the purchasing of epoxy asphalt bond coat from a sole source supplier in order to provide epoxy asphalt concrete surfacing as specified herein.

GENERAL

Epoxy asphalt concrete surfacing shall be placed on the entire orthotropic steel deck roadway, between barriers, to the limits shown on the plans and to a test area on a Caltrans maintenance roadway located at the Toll Plaza of the San Francisco-Oakland Bay Bridge, as designated by the Engineer.

The epoxy asphalt concrete surfacing shall be placed in two (2) courses, a leveling course and a surface course to the total nominal thickness shown on the plans. The leveling course shall be placed to a variable thickness because of variations in the grade of the steel deck.

Epoxy asphalt binder and bond coat each consist of two separate components, an epoxy resin and a petroleum-derived asphalt with resin hardeners, mixed at high temperatures before being metered into the pug mill as binder or being sprayed on the roadway as bond coat. Both epoxy asphalt binder and bond coat require a very rigid control of mixture, time and temperature.

The binder content of the epoxy asphalt paving mixture shall be between 5.7% and 6.3% by mass of total mix. The Contractor shall determine the binder content to be used per the manufacturer's recommendations and as approved by the Engineer.

The Contractor shall submit a quality control plan in conformance with the requirements in "Quality Control" of this section. The submittal of the quality control plan shall conform to the requirements in "Working Drawings," of these special provisions. At a minimum, the quality control plan shall include the following:

- A. Location of the batch plant
- B. Complete list of modifications to the batch plant controls, tanks, and piping
- C. Methods for controlling epoxy asphalt mix properties including gradation, binder content, mix time, and heat control
- D. Hauling times and distances to the jobsite
- E. Provisions for temperature control and monitoring during hauling
- F. Procedures for controlling temperature and application of bond coat
- G. Lay down procedures for epoxy asphalt paving
- H. Procedures for attaining specified compaction
- I. The names, qualifications, and documentation of certifications for the quality control manager and all quality control inspectors
- J. Details, procedures, and schedules of inspection
- K. Name and address of test facility and qualifications of personnel performing the tests
- L. Details, procedures, and schedules of testing as required by these special provisions
- M. Manufacturer's certificates of compliance for both the binder and bond coat

Prior to submitting the quality control plan, a meeting between the Engineer, Contractor, and epoxy asphalt concrete manufacturer shall be held to discuss the requirements of the quality control plan. The meeting shall be held in the San Francisco Bay Area.

After a complete quality control plan is received by the Engineer, the Contractor shall allow the Engineer 10 (ten) working days to review the submittal. An amended quality control plan or addendum shall be submitted to and approved in writing by the Engineer for proposed revisions to the approved QCP. The Contractor shall allow the Engineer 10 (ten) working days to complete the review of the amended quality control plan or addendum. No epoxy asphalt concrete work shall begin until a preliminary approval has been given, in writing, by the Engineer.

Epoxy asphalt concrete surfacing shall be furnished and installed in accordance with the approved quality control plan, including any amendments and addenda, and the recommendations of the manufacturer's representative.

SOLE SOURCE SUPPLIER

The components for epoxy asphalt binder and bond coat shall be obtained from the following manufacturer:

ChemCo Systems, Inc.
2800 Bay Road
Redwood City, California 94063
Telephone: (650) 261-3790
Fax:(650) 261-3799
Contact: Robert Gaul or John Bors

Arrangements have been made by the State with ChemCo Systems, Inc. to ensure that the successful bidder can obtain the epoxy asphalt bond coat and binder components. The prices quoted by ChemCo Systems, Inc. are as follows:

Epoxy asphalt binder \$5.96/-kilogram
Epoxy asphalt bond coat \$5.96/-kilogram

Epoxy asphalt binder and bond coat prices include delivery to the batch plant site.

The above unit prices are based on a minimum combined quantity of binder and bond coat of 220,000 kilograms, delivered in bulk to any site within 64 kilometers of the San Francisco-Oakland Bay Bridge. Prices do not include sales tax. Payment terms are net 45 days after delivery of material.

Price and conditions quoted include all discounts and will be firm for all orders placed on or before December 31, 2003 provided delivery is accepted within 24 months after the order is placed. Total price will be increased by 4% for orders placed with ChemCo Systems, Inc. after December 31, 2003 and on or before December 31, 2004 provided that delivery is accepted within 24 months after the order is placed.

The epoxy asphalt bond coat and binder prices quoted include all materials, technical advice, and inspections by a qualified representative of the manufacturer, both at the batch plant and during installation, along with a final inspection of the in-place epoxy asphalt concrete. The prices also include consultation on the quality control plan and manufacturer's certificates of compliance for both the epoxy binder and epoxy bond coat. The prices also include the rental of a meter/mix machine to process the epoxy asphalt binder at the batch plant the rental of a spray distributor machine to apply the bond coat, each for a period of 60 continuous calendar days.

MATERIALS

Epoxy Asphalt Bond Coat and Binder

Epoxy Asphalt Type V shall be used as the binder for epoxy asphalt concrete and Epoxy Asphalt Type Id shall be used as the bond coat, both as supplied by ChemCo Systems, Inc. and which conform to the following specifications:

Epoxy Resin (Part A for Bond Coat and Binder)		
Property	Value	Method
Viscosity @ 23°C. Poise	110 to 150	ASTM D 445
Epoxide equivalent weight	185 to 192	ASTM D 1652
Color, Gardner. max.	4	ASTM D 1544
Moisture content. % max.	0.05	ASTM D 1744
Flash point, Cleveland open cup. °C, min.	200	ASTM D 92
Specific Gravity @ 23°C.	1.16 to 1.17	ASTM D 1475
Appearance.	Transparent amber	Visual

Part B for Bond Coat and Binder

	Bond Coat	Binder	
Product Designation	Type Id	Type V	
Property	Value	Value	Method
Viscosity @ 100°C. cP, min.	800	140	Brookfield
Specific Gravity @ 23°C	0.98 to 1.02	0.98 to 1.02	ASTM D 1475
Color	Black	Black	Visual
Acid Value, mg KOH/g.	60 to 80	40 to 60	ASTM 664
Flash Point, Cleveland open cup. °C, min.	250	200	ASTM D 92

Parts A and B Combined and Cured

	Bond Coat	Binder	
Product Designation	Type Id	Type V	
Property	Value	Value	Method
Weight Ratio, Parts A/B	100/445	100/585	
Tensile Strength @ 23°C. MPa, min.	6.90	1.52	ASTM D 638
Elongation at break @ 23°C. % min.	180	200	ASTM D 638
Viscosity increase to 1000 cP @ 121°C, Minutes, min.	20	50	See Testing
Thermoset Property @ 300°C	Shall not melt	Shall not melt	Small sample placed on hot plate

Notes: Min = minimum max. = maximum cP = centipoise

Component Part A shall be a liquid diepoxy resin obtained entirely from the condensation of bisphenol A and epichlorohydrin. No diluents, flexibilizers, or plasticizers shall be present. Component Part A shall contain no inorganic fillers, pigments, or other contaminants or insolubles. Component Part A shall be the same for the Type Id bond coat and Type V binder.

Component Part B shall be a homogenous composition of a petroleum-derived asphalt and epoxy resin hardeners. Component Part B shall contain no insolubles such as inorganic fillers or pigments, and no contaminants which would adversely affect automatic metering, mixing, or dispensing.

Components Part A and Part B shall be mixed and applied as specified by the manufacturer and these special provisions.

Specimens for tensile cast sheets of bond material shall be prepared in accordance with the manufacturers recommendation and the following:

- A. Two glass sheets (305 mm X 305 mm X 6.35 mm) shall be coated with a suitable spray-on dry film mold release.
- B. A seal to contain the liquid shall be formed by threading a length of copper or annealed iron wire through a length of latex rubber tubing 3 mm I.D. and 0.75 mm wall thickness. The seal shall be bent into a U-shape and shall be placed to within 25 mm of three edges of the plate.
- C. Three 2.3 mm spacers shall be placed between the seal and the edges of the plate. The second plate shall be placed on top of the assembly with the coated side down. The assembly shall be firmly clamped together and placed in an oven at 121°C for at least 1 hour but no longer than 5 hours to avoid damage to the rubber seal.
- D. The heated assembly shall be removed from the oven and the prepared binder poured into the mold. The mold shall be returned to the oven at 121°C and cured for 4 hours with the mold assembly in the vertical position.
- E. After 4 hours the mold shall be taken from the oven and the clamps removed immediately. The mold shall be allowed to cool for no less than 15 minutes then the spacers shall be removed and the glass plates shall be carefully pried apart. The exposed side shall be dusted with powdered talc and the casting carefully removed from the other plate and the reverse side dusted with talc. The wire in the gasket shall be cut at the two corners and removed from the latex tubing. Brush off excess talc and place the casting on a clean flat surface.

- F. The casting shall be allowed to cool to room temperature and age for a minimum of 10 hours. The Contractor shall cut dumbbell shaped specimens from the casting in accordance with the requirements in ASTM Designation: D412 using a C die. Cut specimens shall be laid out flat and straight and stored at a temperature of 23 +/- 2 °C for a minimum of 12 hours before testing.

Aggregates

Aggregates for epoxy asphalt concrete surfacing shall conform to Section 39-2.02, "Aggregate," of the Standard Specifications and these special provisions.

Aggregates shall be obtained from the following quarries or equal, as determined by the Engineer:

- A. Dumbarton Quarry
- B. Brisbane Quarry

Aggregates shall consist of 100% crushed particles. Elongated particles with an aspect ratio of greater than 1 to 3 should be no more than 5% of all aggregate particles by weight.

The combined aggregate grading shall conform to the following gradation immediately prior to mixing with the epoxy asphalt binder:

Grading Limits of Combined Aggregates
9.5-mm Maximum

Sieve Sizes (mm)	Percentage Passing
12.5	100
9.5	95-100
4.75	65-85
2.36	50-70
600 µm	28-40
75 µm	7-14

The aggregate shall conform to the following quality requirements prior to addition of the epoxy asphalt:

Aggregate Quality Requirements

Test	California Test	Requirement
Loss in Los Angeles Rattler (after 100 revolutions)	211	7% Max
Loss in Los Angeles Rattler (after 500 revolutions)	211	22% Max
Sand Equivalent:	217	
A. Individual Test Results	217	42 min.
B. Moving Average Result	217	45 min.
Film Stripping (Max.)*	302	25 %

* After mixing with AR 4000 paving asphalt

If the results of either or both the aggregate grading and Sand Equivalent tests do not meet the requirements specified, the Contractor shall immediately stop paving operations and the Engineer may require removal of the epoxy asphalt concrete that is represented by the tests.

In addition, the aggregate from each separate batch plant bin used for epoxy asphalt concrete, except for the bin containing the fine material, shall have a Cleanness Value of 57 minimum for "contract compliance" and a 65 minimum for "operating range" as determined by California Test 227, modified as follows:

- A. Tests shall be performed on the material retained on the 2.36-mm sieve from each batch plant bin and shall not be a combined or averaged result.

- B. Each test specimen shall be prepared by hand shaking for 30 seconds, a single loading of the entire sample on a 300 mm diameter, 4.75 mm sieve, nested on top of a 300 mm diameter, 2.36 mm sieve.

Where a coarse aggregate batch plant bin contains material which will pass the maximum size specified and be retained on a 9.5-mm sieve, the test specimen mass and volume of wash water specified for 25 mm x 4.75 mm aggregate size shall be used.

Samples shall be obtained from the batch plant weigh box area during or immediately after discharge from each bin of the batch plant.

If the results of the Cleanness Value tests do not meet the requirements specified for "operating range" but meet the "contract compliance" requirements, placement of the material may be continued for the remainder of that day. However, another day's work may not be started until tests, or other information, indicate to the satisfaction of the Engineer that the next material to be used in the work will comply with the requirements specified for "operating range."

If the results of the Cleanness tests do not meet the requirements for "contract compliance" specified, the Contractor shall immediately stop paving operations and the Engineer may require removal of the epoxy asphalt concrete that is represented by the tests.

Supplemental fine aggregate shall be added to the aggregate as required to conform to the gradation limits specified. Supplemental fine aggregate shall conform to Section 39-3.01, "Storage," and Section 39-3.03A, "Proportioning for Batch Mixing," of the Standard Specifications and the following:

Supplemental fine aggregate shall be ground limestone consisting of a minimum of 90% calcium carbonate, containing no active lime and conforming to the following requirements immediately prior to mixing:

Supplemental Fine Aggregate Requirements		
Test	California Test	Requirement
Composition by mass	202	100%
Percentage Passing 300 μ m Sieve	202	90-100
Surface Area (sq. meter per kg)	340	29 Max
Specific Gravity	208	2.5 Min.
Moisture Content (%)	226	0.2 Max.

The addition of ground limestone will be limited to 4% of the aggregate batch mass.
The addition of bag house dust will be limited to 1% of the aggregate batch mass.

Composite Properties of Epoxy Asphalt Concrete

Epoxy asphalt concrete in the fully cured condition, as defined by the manufacturer, shall have the following properties:

Properties of Fully Cured Epoxy Asphalt Concrete		
Property	Value (Type V)	Test Method
Marshall stability at 60°C, kN, minimum	40.0	ASTM D1559-91
Flow value at 60°C, mm, minimum	2.0	ASTM D1559-91
Recovery at 60°C, percent, minimum	60	ASTM D1559-91
Percent air voids total mix, maximum	3.0	ASTM D3203/1188

The Contractor shall also prepare specimens for testing of uncured epoxy asphalt as follows:

- A. Collect specimen material immediately after discharge from pug mill
- B. Place specimen in a chamber at a controlled temperature of $115^{\circ}\text{C} \pm 2^{\circ}\text{C}$ within 5 minutes of collection.
- C. Specimen shall remain at the specified controlled temperature for a minimum of 60 minutes and a maximum of 70 minutes.
- D. Compact specimen and allow to cool in the molds to $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Cooling in water will not be permitted.
- E. Test shall be performed within 2 hours of reaching 25°C .

The uncured epoxy asphalt concrete shall have the following properties:

Properties of Uncured Epoxy Asphalt Concrete

Property	Value (Type V)	Test Method
Marshall Stability at 60°C , kN, minimum	5.34	ASTM D1559-91
Flow value at 60°C , mm, minimum	2.0	ASTM D1559-91

Storage, Proportioning and Mixing Materials

General – Epoxy asphalt concrete shall be produced in a batch mixing plant.

1. Storage - Aggregate shall be stored in accordance with Sections 39-3.01, "Storage," 39-3.01A, "Cold Storage," and 39-3.01B, "Hot Storage," of the Standard Specifications. For storage purposes, aggregates shall be considered Type A.

Aggregate shall be stored so that separately sized aggregates will not be intermingled. Any aggregate that has intermingled with another size of aggregate shall be removed and replaced with aggregate of specified grading.

Epoxy asphalt binder and bond coat components shall be stored in separate heated tanks that are free of any contaminants and in accordance with Section 39-3.01C, "Asphalt Binder Storage," of the Standard Specifications and these special provisions. Contaminated materials shall be disposed of in accordance with the requirements of Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. During the production of epoxy asphalt concrete by the batch plant, the tanks shall be able to maintain the temperature of the Part A (Epoxy Resin) at 82°C to 93°C and the Part B component of the Binder at 138°C to 149°C .

2. Drying - Aggregates shall be dried in accordance with Section 39-3.02, "Drying," of the Standard Specifications.

3. Proportioning - Aggregates and epoxy asphalt shall be proportioned in accordance with Sections 39-3.03, "Proportioning," and Section 39-3.03A, "Proportioning for Batch Mixing," of the Standard Specifications and these special provisions.

The Contractor shall furnish aggregate samples at least 30 days prior to their intended use.

Samples of the proposed aggregate sizes, including bag house dust and limestone dust, shall be sampled and tested for sieve analysis, specific gravity, and quality determination. The Contractor shall determine per the manufacturers recommendation the blend that most nearly fits the optimum hot bin gradations. The blend shall be approved by the Engineer.

After theoretical design gradations have been determined, cold feed trial runs at different gate settings shall be performed until a blending of the resulting hot bin samples produces a gradation in conformance with the mix design gradation. A full production trial run through the plant at operating temperatures shall be performed and samples taken, separated, and tested. The full production trial run shall be completed and approved by the Engineer before starting the Production Trial.

Adjustments to cold feed settings may be necessary depending on the results of daily samples taken from the hot bins and the results from gradations determined from the extracted paving mixture.

4. Mixing –Aggregate, supplemental fine aggregate, bag house dust and epoxy asphalt binder shall be mixed in a central batch mixing plant in accordance with Sections 39-3.04, "Mixing," and Section 39-3.04A, "Batch Mixing," of the Standard Specifications and these special provisions. ChemCo Systems Meter Mix Machine Model MM2.2 shall be installed at the batch plant and shall be used to meter, mix, and inject mixed binder into the pug-mill of the batch plant.

The batch plant shall conform to the provisions of Section 39-3.06, "Asphalt Concrete Plants," of the Standard Specifications and these special provisions. The plant shall be modified to produce epoxy asphalt concrete. The wet mixing cycle, after all epoxy asphalt binder, aggregates and fine aggregate have been loaded into the pug mill, shall be a minimum of 30 seconds. Depending on the mixing efficiency of the pug mill this minimum time may be increased by the Engineer based on the experience from the Production Trial as described elsewhere in the special provisions.

The plant shall be capable of a minimum production of 50 tonnes per hour with a batch capacity of not less than 1 tonne. Flow meters in the feed lines used to proportion the two epoxy components shall be sealed in accordance with the provisions in the fourth paragraph of Section 9-1.01, "Measurement of Quantities," of the Standard Specifications.

The Contractor's attention is directed to the inter-relationship of batch temperature, hauling times and placement temperature for epoxy asphalt concrete specified in these special provisions. To comply with the above constraints, the location of the batch plant is critical and shall be so located that the batch loading, hauling, and placing times shall comply with the time limits specified in "Spreading and Compacting," of this section.

The epoxy asphalt content of the completed mixture shall be determined by California Test 310 modified as follows:

- A. Use samples of 1500g \pm 150g.
- B. Take field samples and mix with extraction solvent within 15 minutes of discharge of the mixture from the pug mill.
- C. Verify that sample is completely submerged in solvent.
- D. Agitate mixture at least once every 15 minutes until extraction is initiated.
- E. Initiate extraction procedure within 90 minutes of discharge of mixture from the pug mill.

Immediately prior to mixing in the meter mix machine, the temperature of the individual components shall be within the following ranges:

- A. Part A component 82°C to 93°C.
- B. Part B component 138°C to 149°C.

The temperature of the aggregate at the time the epoxy asphalt binder is added shall be sufficient to result in at temperature of the mixture as it is discharged from the pug mill between 110°C and 121°C.

Production Trials :

Before epoxy asphalt concrete surfacing operations are started on the deck, the Contractor shall perform production trials which satisfactorily demonstrate to the Engineer that the plant, equipment and procedures to be employed are adequate for proper production, placement, compaction and finishing of epoxy asphalt concrete surfacing. The Contractor shall notify the Engineer, in writing, at least 10 (ten) working days prior to the start of the Production Trial.

The Contractor shall demonstrate his production operations by applying bond coat and placing at least two paving passes of epoxy asphalt concrete surfacing. The total thickness of the paving shall be 50 mm. The location for the paving pass will be the Caltrans maintenance roadway located at the Toll Plaza of the San Francisco-Oakland Bay Bridge. The paving passes shall not begin until the area involved has been prepared in the same manner specified in "Epoxy Asphalt Bond Coat" elsewhere in this specification. Both passes shall be contiguous to each other and a minimum of 3.65 m wide by not less than 50 m long. During the production trials, the Contractor shall demonstrate his ability to make satisfactory longitudinal and transverse construction joints by stopping the placing operations approximately at the mid-point of the test strip, preparing the construction joint, then resuming the placing operations after a one hour waiting period.

Additional paving passes, at no additional cost to the State, may be required if ordered by the Engineer until the Contractor is able to demonstrate satisfactory production, making longitudinal and transverse construction joints, and producing in-place epoxy asphalt conforming to the requirements in these special provisions. The Contractor shall allow 5 (five) working days between the production trial and the start of the surfacing on the deck of the suspension structure for evaluation, testing, and approval by the Engineer.

Epoxy Asphalt Bond Coat.

1. General. Epoxy asphalt bond coat shall be applied to the area to be surfaced as shown on the plans, as specified in these special provisions, and per the manufacturer's recommendations.

Epoxy asphalt bond coat shall be applied only when the roadway surface is dry, the atmospheric temperature is at least 10°C, and the roadway surface temperature is above 10°C. If heavy fog or rain is imminent or might be reasonably expected before the bond coat can be covered with finished pavement, the bond coat shall not be applied.

Before application of the bond coat, the bridge railing, new pavement and all other portions of the bridge susceptible to spattering by over spray shall be masked with plastic sheets or other wrapping methods approved by the Engineer, or protected with a traveling shield of a suitable material approved by the Engineer. If over spray does occur, over-sprayed areas shall be cleaned at the Contractor's expense to the satisfaction of the Engineer.

Where the protective paint coating on the steel deck has been damaged, regardless of the cause of damage, the steel shall be painted with one application of a zinc rich primer (organic vehicle type), applied by brush, daubers or spraying as specified in Section 59-2.13, "Application of Zinc-Rich Primer," of the Standard Specifications. The paint shall be thoroughly cured prior to application of the epoxy asphalt bond coat.

Prior to the application of the bond coat, the entire area to be paved shall be swept clean, washed with a 1% solution of nonionic surface active agent (Triton X-100 or equal) and scrubbed with stiff bristle brooms or mechanical sweepers to remove all oil, grease, zinc oxides and loose zinc paint. After washing the entire area shall be rinsed by flushing twice with clean water. The wash water and rinse water shall be prevented from entering storm water conveyances and San Francisco Bay in conformance with the provisions in "Non-storm Water Discharges" of these special provisions.

Areas that have been cleaned and later show contamination prior to application of the bond coat shall be re-cleaned.

Surfaces shall be dry when the bond coat is applied.

Immediately prior to mixing in the Spray Distributor machine, the temperature of the individual components shall be within the following ranges:

- A. Part A component 82°C to 93°C
- B. Part B component 143°C to 157°C

The mixed bond coat shall be applied at a rate of 0.68 liters per square meter on the primed steel deck and 0.45 liters per square meter on the first course, unless directed otherwise by the Engineer.

The bond coating shall be uniform and continuous and shall be applied to all vertical surfaces of existing pavement, curbs, barriers, construction joints in the surfacing against which additional material is to be placed, the deck or pavement to be surfaced, and to other surfaces designated by the Engineer.

Bond coat applications shall be placed sufficiently in advance of paving operations to prevent slippage of the paving machine. Bond coat shall be reapplied if the coated areas are not covered within 3 days. If the bond coat becomes wet after application from rain or condensation the epoxy asphalt concrete shall not be placed until the moisture has evaporated. Bond coat shall be applied to an area not exceeding 75-mm wider than the width of the paving pass.

The applicators of the bond coat shall wear protective clothing, including face shields and dust/mist respirators.

Transporting, Spreading and Compacting

1. General - Spreading and compacting equipment shall conform to the requirements of Section 39-5, "Spreading and Compacting Equipment," of the Standard Specifications and as specified in these special provisions.

Epoxy asphalt concrete surfacing shall be placed in 2 (two) courses. Epoxy asphalt mixtures shall be placed only when the roadway surface is dry, the atmospheric temperature is at least 10°C, and the roadway surface temperature is above 10°C. If heavy fog, rain or temperature drop to below 10°C is imminent or might reasonably be expected before placement can be completed or dew is forming, epoxy asphalt mixtures shall not be placed.

After compaction the Contractor shall remove 75 mm along the longitudinal edge by power cutting a 45-degree slope in a general straight longitudinal line. The Contractor shall also remove 150 mm of transverse joints by power cutting to a vertical face and to a neat line. The longitudinal and transverse joints of the leveling and finish courses shall be off set approximately 150 mm.

At locations where the epoxy asphalt concrete is to be placed over areas inaccessible to spreading and rolling equipment, including the railing edge, the epoxy asphalt concrete shall be spread to obtain the specified results and shall be compacted thoroughly to the required lines, grades and cross sections by means of vibrating rollers, pneumatic tampers, or by other methods that will produce the same degree of compaction as required by these special provisions.

2. Transporting – Epoxy asphalt concrete shall be transported from the batch plant to the job site in haul trucks having tight, clean, smooth container bodies that have been oiled with a minimum amount of thin oil, as recommended by the manufacturer, to prevent adhesion of the surfacing mixture to the truck bodies. Each load of surfacing mixture shall be covered with canvas or other approved material to protect the mixture from the weather and to prevent loss of heat. Any load wetted by rain will be rejected. Haul trucks shall have tires with well-defined treads. Trucks with smooth, bald tires will not be permitted.

Each haul truck shall have three, 10 mm holes drilled in the two side walls of the truck bed through which long-stem (approximately 30 cm) thermometers can be inserted for measuring temperature of the mix in the truck. The holes shall be located 30 ± 5 cm above the bottom of the bed and located at the mid point and 60 ± 10 cm from each end of the truck bed. Before each truck leaves the batch plant long-stem thermometers shall be placed into each of the three holes in the side walls of the truck bed.

In order to reach the paving machine haul trucks must pass over uncured bond coat. To minimize tracking of bond coat from the haul truck tires onto the clean steel deck or freshly paved epoxy asphalt, plywood or other suitable material shall be placed on the deck at the location haul trucks drive off of the uncured bond coat after discharging their load into the paving machine.

Epoxy asphalt concrete shall be discharged directly from the mixer into the hauling vehicle, except a holding container such as a front end loader or other device as approved by the Engineer may be used while verifying mix requirements prior to discharging into the hauling vehicle. The use of a storage silo to accumulate batches will not be permitted.

The allowable time between batching at the plant and placing into the paving machine at the job site is dependent upon the temperature of the batch mixture taken at the batch plant. Batches or portions thereof registering below 110°C or above 121°C when discharged from the pug mill will be rejected. No load or portion of a load shall be placed after the specified reject times.

Allowable times between batching at the plant and placing into the paving machine at the job site for respective temperatures, shall conform to the following:

Time Limits For Making And Transporting Epoxy Asphalt Type V

Temperature of Mix* Degrees C	110	111	112	113	114	115	116	117	118	119	120	121
Maximum time in minutes	94	90	86	82	79	76	73	70	66	63	60	57
Minimum time in minutes	69	66	63	60	58	55	53	51	49	48	46	45

Notes:

1. *Temperature of Mix is average temperature of all batches in a truck load.
2. Maximum time is the longest time allowable from making first batch in a truckload to emptying truck into paving machine.
3. Minimum time is the shortest time allowable from making first batch in a truckload to emptying truck into paving machine.

The temperature of each load shall be measured as each haul truck reaches the bridge deck using the long stem thermometers that had been inserted through the holes in the truck bed side wall and into the paving mix at the batch plant. If any of the three thermometers are not embedded in the load because of the manner of placement of the load in the truck that reading shall be disregarded in calculating the average temperature. Any load that with a temperature registering below 110°C or above 121°C, based on the average temperature determined with these three temperature readings, will be rejected. Rejected loads shall be removed from the bridge deck.

Each haul truck shall carry a record of the average temperature of all batches in the truck and time of first and last batch into the truck. Any rise in the temperature of a batched mix of epoxy asphalt concrete at the time of placement in the paving machine shall be cause for rejection of the batch by the Engineer.

3. Spreading – Epoxy asphalt concrete mix shall be placed with an asphalt-paving machine as specified herein. The epoxy asphalt mix shall be deposited directly from the haul trucks into the hopper of the paving machine. Depositing the epoxy asphalt mix in a windrow followed by pickup and placement into the hopper of the asphalt-paving machine by loading equipment will not be permitted.

In addition to the requirements in Section 39-5.01, "Spreading Equipment," of the Standard Specifications, epoxy asphalt paving equipment shall be equipped with automatic screed controls and sensing devices.

The deck surface shall be surveyed to determine flatness. If the plane of the deck does not vary more than ± 3 mm over 3.6 m, a ski may be used with the paving machine to control the thickness of the pavement.

When placing epoxy asphalt concrete the automatic controls shall control the longitudinal grade and transverse slope of the screed. Grade and slope references shall be furnished, installed and maintained by the Contractor. Should the Contractor elect to use a ski device, the minimum length of the ski device shall be 10 m. The ski device shall be a one-piece unit and the entire 10-m length shall be utilized in activating the sensor.

When placing epoxy asphalt concrete, on the initial paving pass, the end of the screed nearest the centerline shall be controlled by a sensor activated by a ski device not less than 10-m long. The opposite end of the screed shall be controlled by an automatic transverse slope device set to reproduce the cross slope designated by the Engineer and maintaining the minimum thickness of the course.

When paving contiguously with previously placed mats, the end of the screed adjacent to the previously placed mat shall be controlled by a sensor that responds to the grade of the previously placed mat and will reproduce the grade in the new mat within a 3-mm tolerance. The end of the screed farthest from the previously placed mat shall be controlled in the same manner as when placing the initial mat.

Should the methods and equipment furnished by the Contractor fail to produce a layer of epoxy asphalt concrete conforming to the requirements, including straightedge tolerance required in Section 39-6.03, "Compacting," of the Standard Specifications, the paving operations shall be discontinued and the Contractor shall modify his equipment or furnish substitute equipment in order to achieve the specified results.

Should the automatic screed controls fail to operate properly during any day's work, the Contractor may use manual control of the spreading equipment to place the epoxy asphalt concrete already mixed and on hand. However the equipment shall be corrected or replaced with alternative automatically controlled equipment conforming to the requirements in this section before restarting the batch plant.

The epoxy asphalt concrete shall be placed in 2 (two) lifts. The first course (leveling course) shall establish a uniform finished grade within $25 \text{ mm} \pm 3 \text{ mm}$ of the final grade. The final compacted thickness of the pavement shall be $50 \text{ mm} \pm 3 \text{ mm}$. The minimum thickness of either course shall be 19 mm.

4. Compacting - Rolling shall produce an epoxy asphalt concrete surface of uniform smoothness and density and a pavement that has a maximum 3% air voids, as measured in accordance with ASTM Designation: D3203. The Engineer may require cores to be taken from the completed pavement to measure air void content.

A minimum of two tandem steel-tired rollers weighing not less than 9,000 kg or more than 12,000 kg and two pneumatic-tired roller, all fully operated, shall be furnished for each paving machine operated on the project. Pneumatic tired rollers shall be not less than 1.2 m in width and with all tires of equal size and diameter and shall have a tread approved by the Engineer. Wobble-wheeled rollers will not be permitted. The tires shall be so spaced that the gaps between adjacent tires will be covered by the following tires. The tires shall be inflated to 620 kPa and have an operating mass per tire of not less than 900 kg.

The initial or breakdown compaction for the leveling course shall be performed with a pneumatic-tired roller and shall consist of 3 coverages of the epoxy asphalt concrete, and shall be completed before the temperature of the mix drops below 82°C . The initial or breakdown compaction for the leveling course shall be followed immediately with a steel-tired tandem roller and shall consist of 3 coverages. Final rolling shall be performed with a pneumatic-tired roller and shall consist of 3 coverages before the temperature drops to 65°C .

The initial or breakdown compaction for the surface course shall be performed with a steel-tired tandem roller and shall consist of 3 coverages of the epoxy asphalt concrete, and shall be completed before the temperature of the mix drops below 82°C . The initial or breakdown compaction for the surface course shall be followed immediately with a pneumatic-tired roller and shall consist of 3 coverages. The surface course of the epoxy asphalt concrete shall be compacted additionally without delay by a final rolling consisting of not less than 3 coverages with a steel-tired roller weighing not less than 9,000 kg, and shall be completed before the temperature of the mix drops below 65°C .

Minimum amounts of water shall be used on rollers as required to prevent pickup of paving materials. Additives may be used as release agents provided they are approved by the manufacturer. Rollers shall be equipped with scrapers or brushes to remove any paving material that may be picked up.

Random blisters shall be punctured immediately with a sharp object and the area re-compacted.

If the finished surface of the epoxy asphalt concrete on the traffic lanes does not meet the specified surface tolerances, it shall be brought within tolerance by either (1) abrasive grinding with fog seal coat on the areas which have been ground or (2) removal and replacement. The method will be selected by the Engineer. The corrective work shall be at the Contractor's expense.

If abrasive grinding is used to bring the finished surface to specified surface tolerances, additional grinding shall be performed as necessary to extend the area ground in each lateral direction so that the lateral limits of grinding are at a constant offset from, and parallel to, the nearest lane line or pavement edge, and in each longitudinal direction so that the grinding begins and ends at lines normal to the pavement centerline, within any ground area. All ground areas shall be neat rectangular areas of uniform surface appearance. Abrasive grinding shall conform to the requirements in the first paragraph and the last four paragraphs in Section 42-2.02, "Construction," of the Standard Specifications.

Vehicles and equipment will not be permitted to stand on the freshly paved epoxy asphalt until 48 hours after final rolling.

The Contractor shall remove excess loose material by means of a vacuum sweeper.

Unless otherwise permitted by the Engineer, the use of water to cool the mat will not be permitted.

QUALITY CONTROL

During paving operations, including the Production Trail, samples shall be taken and tested as follows:

- A. Cold feed bins shall be sampled and tested to determine Sand Equivalent, aggregate grading, and Cleanness Value twice each day
- B. Epoxy asphalt concrete mixture shall be sampled and tested in the uncured condition to determine Marshall stability, and flow value twice per 100 tonnes of paving
- C. Epoxy asphalt concrete mixture shall be cured as determined by the manufacturer and tested to determine Marshall stability, flow value, percent recovery and percent air voids twice per 100 tonnes of paving
- D. Extraction shall be performed on the paving mixture in accordance with California Test 310, as modified by these special provisions, and determination made of binder content twice each day
- E. Extraction shall be performed on the paving mixture in accordance with California Test 310, as modified by these special provisions, and sieve analysis performed on the extracted aggregate twice each day
- F. At the start of each day's bond coat application, a sample shall be taken from the spray wand and a tensile sheet cast and tested as specified in "Epoxy Asphalt Bond Coat and Binder" of these special provisions

MEASUREMENT

The quantity of epoxy asphalt concrete aggregate measured in accordance with the provisions in Section 9-1.01, "Measurement of Quantities," of the Standard Specifications, will be the difference between the mass of the completed mixture and the mass of the epoxy asphalt binder added thereto, and will be paid for by the tonne as epoxy asphalt concrete aggregate.

Epoxy asphalt bond coat and binder will be measured and paid for by the kilogram as epoxy asphalt bond coat and binder. Component materials shall be weighed separately or combined. Quantities of bond coat and binder component materials remaining at the end of the surfacing work shall be measured and deducted from payment quantities if such materials have been previously included in payment measurements.

Apply epoxy asphalt bond coat and place epoxy asphalt concrete surfacing will each be measured by the square meter, and will be paid for as apply epoxy asphalt bond coat and place epoxy asphalt concrete surfacing. The area to be paid for will be calculated from the contract plans and field measurements. When field measurements are made, measurements will be made to the nearest 30 mm. Areas will be calculated to the nearest tenth of a square meter.

PAYMENT

The above contract prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing epoxy asphalt concrete complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for supplemental fine aggregate shall be considered as included in the contract price paid per tonne for epoxy asphalt concrete aggregate, and no additional compensation will be allowed therefor.

Full compensation for performing cold feed trial runs and full production runs shall be considered as included in the various contract items involved for epoxy asphalt concrete, and no additional compensation will be allowed therefor.

Full compensation for producing and testing specimens shall be considered as included in the contract price paid per square meter for place epoxy asphalt concrete surfacing and no additional compensation will be allowed separate payment will be made therefor.

Full compensation for conforming to the requirements of quality control shall be considered as included in the various contract items involved for epoxy asphalt concrete and no additional compensation will be allowed therefor.

Full compensation for repairing damaged paint on the steel deck shall be considered as included in the various contract items involved for epoxy asphalt concrete and no additional compensation will be allowed therefor.

**ALTERNATIVE 1
04-0120F4**

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
141	030735	CCSF SEWER FORCE MAIN (10 NPS)	M	640		
142	030736	CCSF WATER MAIN (12 NPS)	M	640		
143	030737	DOMESTIC WATER (2 NPS) (T1 TOWER)	M	152		
144	030738	DOMESTIC WATER (2 1/2 NPS)	M	2560		
145	030739	COMPRESS AIR (4 NPS)	M	2560		
146	030740	COMPRESS AIR (3 NPS) (T1 TOWER)	M	152		
147	030741	65 MM WATER LINE	M	45		
148	030742	75 MM WATER LINE	M	18		
149	030743	100 MM COMPRESSED AIR PIPE	M	43		
150	030744	150 MM COMPRESSED AIR PIPE	M	15		
151	030745	DEHUMIDIFIER SYSTEM	LS	LUMP SUM	LUMP SUM	
152	BLANK					
153	030747	BOOSTER PUMP STATION	EA	1		
154	BLANK					
155	031195	TRANSPORTATION FOR THE ENGINEER	LS	LUMP SUM	LUMP SUM	
156	031196	PHOTO SURVEY OF EXISTING FACILITIES	LS	LUMP SUM	LUMP SUM	
157	031197	VIBRATION MONITORING	LS	LUMP SUM	LUMP SUM	
158	031198	CONSTRUCTION SURVEY	LS	LUMP SUM	LUMP SUM	
159	031199	ESTABLISH MARINE ACCESS	LS	LUMP SUM	LUMP SUM	
160	BLANK					

ENGINEER'S ESTIMATE

04-0120F4

ALTERNATIVE 1

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
161	031526	SAS SUPERSTRUCTURE ROADYWAY WESTBOUND	LS	LUMP SUM	LUMP SUM	
162	999990	MOBILIZATION	LS	LUMP SUM	LUMP SUM	

TOTAL BID: _____

ALTERNATIVE 1

FOREIGN STEEL AND IRON ALTERNATIVE

ALTERNATIVE 2
04-0120F4

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
141	030735	CCSF SEWER FORCE MAIN (10 NPS)	M	640		
142	030736	CCSF WATER MAIN (12 NPS)	M	640		
143	030737	DOMESTIC WATER (2 NPS) (T1 TOWER)	M	152		
144	030738	DOMESTIC WATER (2 1/2 NPS)	M	2560		
145	030739	COMPRESS AIR (4 NPS)	M	2560		
146	030740	COMPRESS AIR (3 NPS) (T1 TOWER)	M	152		
147	030741	65 MM WATER LINE	M	45		
148	030742	75 MM WATER LINE	M	18		
149	030743	100 MM COMPRESSED AIR PIPE	M	43		
150	030744	150 MM COMPRESSED AIR PIPE	M	15		
151	030745	DEHUMIDIFIER SYSTEM	LS	LUMP SUM	LUMP SUM	
152	BLANK					
153	030747	BOOSTER PUMP STATION	EA	1		
154	BLANK					
155	031195	TRANSPORTATION FOR THE ENGINEER	LS	LUMP SUM	LUMP SUM	
156	031196	PHOTO SURVEY OF EXISTING FACILITIES	LS	LUMP SUM	LUMP SUM	
157	031197	VIBRATION MONITORING	LS	LUMP SUM	LUMP SUM	
158	031198	CONSTRUCTION SURVEY	LS	LUMP SUM	LUMP SUM	
159	031199	ESTABLISH MARINE ACCESS	LS	LUMP SUM	LUMP SUM	
160	BLANK					

**ALTERNATIVE 2
04-0120F4**

Item	Item Code	Item	Unit of Measure	Estimated Quantity	Unit Price	Item Total
161	031526	SAS SUPERSTRUCTURE ROADYWAY WESTBOUND	LS	LUMP SUM	LUMP SUM	
162	999990	MOBILIZATION	LS	LUMP SUM	LUMP SUM	

TOTAL BID: _____

**ALTERNATIVE 2
DOMESTIC STEEL AND IRON ALTERNATIVE**